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spores are differentiated and set free. The first partial differentiation and movement of the spore-origins is regarded as the counterpart of the first swarming period of the zoospores of the Saprolegniales. This view derives diplanetism from a more primitive state among the lower fungi, while there is nothing among the algae which corresponds to the phenomenon.

It is further pointed out that some other phenomenon, such as heterogamy, isogamy, and the proliferation of the sporangium, each have a primitive counterpart among the Chytridiales, and can be traced in a natural series to the Saprolegniales and Oomycetes. For some of the phenomena, like the proliferation of the sporangium, there is no counterpart whatever among the algae.—H. HASSELBRING.

Cultures of Uredineae.—In continuation of the long series of experiments in his cultural work on the Uredineae, the cultures made in 1908 have been reported by ARTHUR.[15] The most interesting result of the work of that year is the discovery that the aecidial stage of *Gymnosporangium externum* Arthur and Kern (described as new) occurs on a herbaceous perennial, *Porteranthus stipulatus* (Muhl.) Britton. This is the only case known of the occurrence of an aecidium of Gymnosporangium on a plant outside of the Pomaceae. Another unusual case is that of *G. Libocedri* (P. Henn.) Kern, whose aecidial stage is shown to be *Aecidium Blasdaleanum* D. and H., a true aecidium and not belonging to the Roestelia type as in all other Gymnosporangia. Series of cultures with 13 species of rusts gave negative results, and cultures with 23 species confirmed and supplemented work previously reported. The relations of the following species have been worked out for the first time: *Puccinia absinthii* DC. on *Artemisia dracunculoides* Pursh has no aecidia, but has pycnidia on the same host; *P. macrospora* (Peck) Arthur on *Carex comosa* Boott sown on *Smilax hispida* Muhl.; *P. patruclis* Arth. on *Carex pratensis* Dreej. sown on *Agoseris glauca* (Pursh) Green; *P. cinerea* Arth. on *Puccinellia airoides* (Nutt.) Wats. and Coult. sown on *Oxygraphis cymbalaria* (Pursh) Prantl; *P. Koeleriae* Arth. on *Koeleria cristata* (L.) Pers. sown on *Mahonia aquifolium* (Pursh) Nutt.; *P. alternans* Arth. on *Bromus Porteri* (Coult.) Nash sown on *Thalictrum dioicum* L.; *P. obliterata* Arth. on *Agropyron biflorum* R. and S. sown on *Aquilegia canadensis* L.; *P. Muhlenbergiae* Arth. and Holw. on *Muhlenbergia glomerata* Trin. sown on *Callirhoe involucrata* (T. and G.) A. Gray; *Gymnosporangium Libocedri* (P. Henn.) Kern on *Libocedrus decurrens* Torr. sown on *Crataegus Pringlei* Sarg.; and *G. externum* Arth. and Kern on *Juniperus virginiana* L. sown on *Porteranthus stipulatus* (Muhl.) Britt.—H. HASSELBRING.

Biology of Gymnosporangium.—Another interesting example showing the slight degree of differentiation existing among some species of parasitic fungi has been brought out by FISCHER[16] in the case of the gymnosporangia inhabiting Juniperus. A casual attempt to infect *Sorbus aria*, *S. aucuparia*, and some other species, with teleutospores obtained from *Juniperus communis* and supposed to be those of *Gymnosporangium tremelloides*, resulted in no infections. This experiment showed that the teleutospores were neither those of *G. tremelloides* nor those of *G. juniperinum*, whose aecidial host is *Sorbus aucuparia*. These results led to a series of cross infections, in which the teleutospores of the Gymnosporangium were used to infect a number of pomaceous plants, and aecidial spores from these plants were sown on Juniperus. The work showed that two forms of Gymnosporangium occur on *Juniperus communis* and *J. nana*. The first form occurs chiefly on the stems and branches, rarely on the leaves, and has its aecidial form on *Amelanchier ovalis*. The first aecidia appear on *A. ovalis* 55 to 60 days after the sowing of teleutospores, and the teleutospores appear on Juniperus about 20 months after the sowing of aecidiospores. For this form the specific name *Amelanchieris*, originally applied to the Roestelia on Amelanchier, is reserved. The second form occurs chiefly on the leaves of Juniperus, and has its aecidial form on *Sorbus aucuparia*, but does not infect *A. ovalis*. The aecidia appear 45 to 50 days after the sowing of teleutospores, and teleutospores are produced in the spring following the sowing of the aecidiospores in late summer. This is the form known as *G. juniperinum*.

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[15] ARTHUR, J. C., Cultures of Uredineae in 1908. Mycologia **1**:225–256. 1909.

For a discussion of the history, nomenclature, and geographical distribution of the two forms, as well as of their respective hosts, the reader is referred to the original paper.—H. HASSELBRING.

Fermentation of tobacco.—Theories relating to the fermentation of tobacco have been based either on the view that the process is due to bacterial action, or to the action of enzymes without the intervention of bacteria. One investigator alone, SCHLOESING, seems to have believed that the later part of the fermentation is due to purely chemical oxidations. In view of these conflicting theories describing the process, the experiments of BOEKHOUT and DEVRIES are especially interesting.[17] These authors attacked the problem by methods similar to those used in their recent work on the spontaneous heating of hay. Dry samples of cured tobacco were sealed up in tubes with oxygen or air, and in some cases water was added to the samples. The tubes were then heated to 100° or to 33°, according to the purpose of the experiment, and after a definite period of heating the gas in the tubes was analyzed. It was found that oxidation took place at both tempera tures, but more rapidly at the higher temperature. The presence of water increased the rate of oxidation. By the process of oxidation carbon dioxid was liberated and oxygen was fixed. It was found that starch and pentosans were

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[16] FISCHER, ED., Studien zur Biologie von *Gymnosporangium juniperinum*. Zeit. Bot. **1**:683–714. *figs. 8.* 1909.

[17] BOEKHOUT, F. W., AND DEVRIES, O. J. J., Ueber Tabaksfermentation. Centralbl. Bakt. II. **24**:496–511. 1909.